

### REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 11-32 are presented for consideration. Claims 11, 14-16, 18, 28, 30 and 32 are independent. Claims 33 and 34 have been canceled without prejudice or disclaimer. Claims 18, 28, 30 and 32 have been amended to clarify features of the subject invention. Support for these changes can be found in the original application, as filed. Therefore, no new matter has been added.

Claims 11-17, withdrawn from consideration, have been retained in this application in order to preserve Applicant's rights. Applicant requests that the Examiner contact his undersigned representative should it be necessary to cancel these claims in order to advance the subject application to issue.

Applicant request favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Claims 18, 22, 23 and 28-34 were rejected under 35 U.S.C. § 103 as being unpatentable over published U.S. patent application number 2002/0145711 to Magome et al. Claims 19-21 and 24-27 were rejected under 35 U.S.C. § 103 as being unpatentable over the Magome et al. publication in view of published U.S. patent application number 2003/0020888 to Tanaka et al. Applicant submits that the cited art does not teach many features of the present invention as previously recited in claims 18-34. Therefore, these rejections are respectfully traversed.

Nevertheless, Applicant submits that independent claims 18, 28, 30 and 32, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, independent claim 18 recites an exposure apparatus that includes a projection optical system for projecting a pattern formed on a mask, onto an object to be exposed, which projection optical system has a plurality of optical elements. The projection optical system also has a first space enclosed with two optical elements of the plurality of optical elements and filled with a helium gas, and a second space enclosed with two optical elements of the plurality of optical elements and filled with a nitrogen gas. A pressure of the first space is higher than that of the second space.

In another aspect of the present invention, independent claim 28 recites a device manufacturing method that includes exposing an object by using an exposure apparatus which comprises a projection optical system for projecting a pattern formed on a mask, onto the object to be exposed, which projection optical system has a plurality of optical elements. The projection optical system also has a first space enclosed with two optical elements of the plurality of optical elements and filled with a helium gas and a second space enclosed with two optical elements of the plurality of optical elements and filled with a nitrogen gas, with a pressure of the first space being higher than that of the second space. The method also includes developing the exposed object.

In a further aspect of the present invention, independent claim 30 recites an exposure apparatus that includes a projection optical system for projecting light from a pattern formed on a mask illuminated by using a light source, onto an object to be exposed, which projection optical

system has first, second and third optical elements, a first supply device for supplying a helium gas to a first space, which is contained by the first optical element and the second optical element, a first exhaust device for exhausting an atmosphere of the first space, a second supply device for supplying a nitrogen gas to a second space, which is contained by the second optical element and the third optical element, and a second exhaust device for exhausting an atmosphere of the second space. A pressure of the helium gas in the first space is higher than a pressure of the nitrogen gas in the second space.

In yet another aspect of the invention, independent claim 32 recites a device manufacturing method that includes exposing an object by using an exposure apparatus, which includes those features discussed above with respect to independent claim 30, and a further step of developing the exposed object.

Applicant submits that the cited art does not teach or suggest such features of the present invention, as recited in independent claims 18, 28, 30 and 32.

The Magome et al. publication relates to an exposure apparatus having an illumination system which applies an exposure energy beam to a mask on which a pattern for transfer is formed, and a stage system for positioning a substrate to which a pattern of the mask is transferred. A gas supply apparatus supplies a gas, having a high transmissivity with respect to the exposure energy beam and having good thermal conductivity, to at least a portion of an optical path of the exposure energy beam. Also provided is a gas recovery apparatus for recovering at least a portion of the gas after the gas is supplied to the optical path of the exposure energy beam from the gas supply apparatus.

In more detail, the Magome et al. publication teaches, in paragraph 0064, that a temperature controlled helium gas having a predetermined concentration or greater is supplied to the entirety of the space within the barrel of the projection optical system PL “(the space between the plurality of lens elements)” from the helium circulation apparatus in the lower floor and via branch pipe 31b of pipe 31 and opening and closing valve V14. Further, temperature and pressure controlled nitrogen gas ( $N_2$ ), the amount of oxygen contained in which is maintained at an extremely low level, is supplied from a nitrogen circulation apparatus in a lower floor to the interior of environment chamber 7 via pipe 88. The nitrogen gas circulating in the interior of the environment chamber 7 is recovered in pipe 33 via exhaust holes in the bottom surface of the environment chamber 7. The recovered nitrogen gas is returned to the nitrogen circulation apparatus.

Thus, in the Magome et al. publication, as discussed in paragraph 0066, helium gas is supplied to the optical path of the ultraviolet pulse light IL from the output surface of the  $F_2$  laser light source 3 to the main condenser lens system 19, as well as to the optical path of the ultraviolet pulse light IL within the projection optical system PL. Further, the spaces from the main condenser lens system 19 to the plane of incidence of the projection optical system PL, and the from the output surface of the projection optical system PL to the surface of the wafer W are supplied with nitrogen gas. In the Magome et al. publication, therefore, the nitrogen gas is supplied only to the space CH1 enclosing the reticle stage and the space CH2 enclosing the wafer stage, but not to the projection optical system PL. Rather, only helium gas is supplied to the projection optical system PL.

In short, then, the Magome et al. publication merely discloses an exposure apparatus that supplies clean, dry air into the apparatus, nitrogen gas into the reticle and wafer spaces, and helium gas into the lens barrel of the projection optical system, and suggests that a pressure of the nitrogen gas be set to be higher than that of the clean, dry air, in order to prevent the air from flowing into a nitrogen purge space.

Applicant submits, therefore, that the Magome et al. publication does not teach or suggest the salient features of Applicant's present invention, as recited in independent claims 18, 28, 30 and 32 in which a projection optical system has a first space enclosed with two optical elements of a plurality of optical elements, which space is filled with a helium gas, and a second space enclosed by two optical elements of the plurality of optical elements and filled with a nitrogen gas, with the pressure of the first space being higher than that of the second space. Accordingly, the Magome et al. publication does not teach or suggest many features of the present invention, as recited in the independent claims.

Applicant further submits that the remaining art cited does not cure the deficiencies noted above with respect to the Magome et al. publication.

The Tanaka et al. publication teaches an exposure apparatus which applies exposure light from an exposure light source to a reticle through an illuminating optical system to project a pattern image of the reticle onto the photosensitive substrate through a projection optical system. A gas supply device 150 fills spaces formed between optical elements in a lens barrel housing the projection optical system therein with an inert gas. Pressure sensors sense the pressures in the spaces and optical performance adjustment devices adjust the optical performance of the

projection optical system. Either nitrogen gas or helium gas is supplied by the gas supply device 150 into the lens barrel housing LB, which contains the projection lenses. A gas discharge device 160 withdraws the gas that has been supplied to the lens barrel LB. Accordingly, the Tanaka et al. publication merely teaches producing a pressure difference between two spaces, which are filled with the same inert gas, in the lens barrel of a projection optical system.

Applicant submits, therefore, that the Tanaka et al. publication, as with the Magome et al. publication, does not teach or suggest at least the features of the present invention recited in independent claims 18, 28, 30 and 32 of a projection optical system having a plurality of optical elements, wherein the projection optical system has a first space enclosed by two optical elements of the plurality of optical elements and filled with a helium gas and a second space enclosed by two optical elements of the plurality of optical elements and filled with a nitrogen gas, wherein a pressure of the first space is higher than that of the second space. Accordingly, the Tanaka et al. publication adds nothing to the teachings of the Magome et al. publication that would render obvious Applicant's present invention, as recited in those independent claims.

For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 18, 28, 30 and 32, is patentably defined over the cited art.

Dependent claims 19-27, 29 and 31 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010 All correspondence should continue to be directed to our address given below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Steven E. Warner", is written over a horizontal line.

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